DOCUMENT RESUME

ED 186 451 TM 800 138

AUTHOR Essex, Diane L.: And Others
TITLE A Comparison of the Predictive Validity of the New and Old Medical College Admission Test with the Predictive Validity of Programmatic Variables Collected During the First Two Months of the Basic Medical Science Program.
PUB DATE Apr 80
NOTE 20p.: Paper presented at the Annual Meeting of the American Educational Research Association (64th, Boston, MA, April 7-11, 1980).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Achievement: *College Entrance Examinations: Grade Point Average: Higher Education: *Medical Schools: *Predictive Validity: Predictor Variables: Science Tests: Scores
IDENTIFIERS Basic Science Comprehensive Test: *Entrance Examinations: *Medical College Admission Test: National Board of Medical Examiners: Test Revision

ABSTRACT

The predictive validity of the new Medical College Admission Test (MCAT) was examined: the validity coefficients were compared to those obtained from previous versions of the MCAT and from performance data gathered early in a first-year basic science program. Data were collected from about 400 medical students, including: (1) MCAT subscores--biology, chemistry, physics, science problems, reading skills analysis, and quantitative skills analysis: (2) undergraduate grade point average: (3) test scores on locally-developed basic science tests, the Level III examinations: (4) scores on the Basic Science Comprehensive examination: and (5) scores on the National Board of Medical Examiners Part I examination, administered after the first year of medical school. The data were gathered between 1976 and 1980. The highest validity coefficients were obtained when total scores from locally developed examinations were used to predict performance on the two certifying examinations, the Basic Science Comprehensive and the National Board. The predictive validity of the new MCAT appeared to be superior to that of its predecessor. Further study investigating the stability of validity coefficients over several classes of students was recommended. (Author/GDC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED186451

A Comparison of the Predictive Validity of the New and Old Medical College Admission Test with the Predictive Validity of Programmatic Variables Collected During the First Two Months of the Basic Medical Science Program

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

D. L. Essex, D. S. Thomson, and W. E. Sorlie

University of Illinois, Urbana-Champaign

ABSTRACT

The predictive validity of the new MCAT was examined; the validity coefficients were compared to those obtained from previous versions of the MCAT and from performance data gathered early in a first-year basic science program. The data were gathered from 1976-1980. The highest validity coefficients were obtained when total scores from locally developed examinations were used to predict performance on two certifying examinations. The predictive validity of the new MCAT appeared superior to that of its predecessor. Additional study is necessary to determine if validity coefficients from the new MCAT will remain stable over several classes of medical students.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

D.L. Essex

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

TM800 138

A Comparison of the Predictive Validity of the New and Old Medical College Admission Test with the Predictive Validity of Programmatic Variables Collected During the First Two Months of the Basic Medical Science Program

D. L. Essex, D. S. Thomson, and W. E. Sorlie
University of Illinois, Urbana-Champaign

Medical educators have long been concerned with the prediction of student success in medical school; one of the first studies appears in the literature in the mid 1920's (Bott, 1925). Since that time, numerous investigations have been published. Researchers have typically given consideration to premedical achievement, often reflected in the undergraduate grade-point average (Thomson, Essex, and Sorlie, 1978) and scientific aptitude, generally measured by the Medical College Admission Test--MCAT (Gough, 1978). Success in medical school has been defined somewhat differently by various researchers; for example, success has been operationalized as first-year medical school grades (Gough, Hall, and Harris, 1963), performance on a year-end certifying examination (Sorlie, Anderson, Gamble, and Bloomfield, 1973), or rank in the first-year class.

Results from past prediction research have been somewhat disappointing, i.e., validity coefficients have been low and unstable across classes of students. For example, undergraduate grade-point average has been used extensively in the prediction of success; validity coefficients have seldom exceeded 0.35 and have fluctuated between zero and about 0.40 across classes. The predictive validity of personality variables has also been analyzed (Ambrosino and Brading, 1973; Best, Dickema, Fisher, and Smith, 1971; Schwartzman, Hunter, and Lohrenz, 1962). However, the inclusion of personality variables has not increased validity coefficients. Further, MCAT

subscores have also been used in the prediction of success; but, validity coefficients have remained low (Crowder, 1959; Gough and Hall, 1964; Richards and Taylor, 1961; Thomson et al., 1978).

As early as 1972, it had been suggested that the MCAT should be revised. Richards (1972) prepared a review of the examination which appeared in Buro's Seventh Mental Measurement Yearbook. He noted that the predictive validity coefficients of MCAT scores with achievement in medical school were exceedingly low; MCAT scores correlated between 0.06 and 0.22 with rank in class in the preclinical years and between 0.09 and 0.14 with rank in class in the clinical years. A second report, prepared by the Association of American Medical Colleges (1972), was an evaluation of extant admission procedures at various medical schools. One of the major findings was that a major revision of the MCAT was necessary because it had questionable predictive validity. The Old MCAT was replaced eventually by the New MCAT which was designed to provide information more relevant to medical school curricula and medical practice.

With the development of the New Medical College Admission Test, questions are again raised about the predictive validity of that examination. As stated in the "New MCAT Student Manual" (AAMC, 1976), "Procedures were developed to define the science knowledge and analytic skills that were considered necessary for medical school matriculants. The New MCAT was designed in an attempt to measure that knowledge and skills that were thus identified (p. 37)." This emphasis on the measurement of skills and knowledge necessary for medical school matriculants adds new hope that the revised version may be more predictive of success in medical school than its predecessor.

To date, only preliminary results are available relative to the predictive validity of the New MCAT. In a document entitled New Medical College Admission Test: Interpretive Manual (1977), the developers of the New

MCAT present results from their predictive validity studies. It was noted that, "These studies were subject to a number of concerns, such as restricted variability on both the criterion and predictor variables, unknown reliabilities of criterion measures, and uncertainty regarding the motivation and preparation of the sample populations, which tended to limit the generality and utility of the results (Deighton, Smith, and Gallagher, 1979, p. 134)." Deighton, Smith, and Gallagher (1979) conducted another study and obtained low to moderate correlations between the New MCAT scores and scores on unit examinations covering cardiovascular, gastrointestinal, and respiratory/renal systems. However, these authors did not report the correlations between the Old MCAT scores with these same criterion variables. Thus, the reader is unable to determine if these results show the New MCAT to have greater or lesser predictive validity than the Old MCAT.

Thus, one objective of the present study was to examine the predictive validity of the new MCAT and compare the validity coefficients with those obtained from the previous versions of that examination. A second objective was to compare the predictive validity of both versions of the MCAT with validity coefficients obtained when using (1) undergraduate grade-point average (UGPA), (2) UGPA and MCAT scores in conjunction with each other, and (3) performance data gathered during the first two months of a basic medical science program. The goal was to determine which set of variables produced the highest validity coefficients for predicting success in the first year of medical school.

METHOD

Subjects. Data were collected from four first-year basic medical science classes beginning in 1976 (graduating Class of 1980) and continuing to the present (graduating Class of 1983). Data were gathered from approximately 400 students.

The students from whom the data were gathered were enrolled in a one-year individually-guided basic medical science program; this particular basic medical science program was one of two offered by the College of Medicine. The second program was offered at a different campus.

Instrumentation and procedures. The data assembled for each student included (1) subscores from the Medical College Admission Test (MCAT), (2) undergraduate grade-point average (UGPA), (3) total test scores from locally developed teaching/learning basic science examinations (Level III examinations), (4) total test scores from a college-developed certifying examination, the Basic Science Comprehensive, and (5) total scores from the National Board: Part I examination, which some students took at the completion of their first year in medical school. Relative to the Old MCAT, four subscores (Verbal, Quantitative, General Information, and Science) were available for students in the Classes of 1980 and 1981. However, with the use of the New MCAT, six subscores were available for students in the Classes of 1982 and 1983; these were Biology, Chemistry, Physics, Science Problems, Skills Analysis: Reading, and Skills Analysis: Quantitative.

The Level III examinations are locally developed basic medical science examinations which were taken via computer following the students completion of a curriculum segment. These examinations consisted of about 200 multiple-choice items organized by subtests which correspond to basic medical science disciplines, e.g., Biochemistry, Histology. Subtest reliabilities, as estimated by KR-20, generally ranged from about 0.25 for subtests with 10-15 items to 0.70 for subtests with 25-35 items.

The basic science comprehensive (BSC) is a college-approved certifying examination consisting of about 500 multiple-choice items organized by subtests which also correspond to basic science disciplines; KR-20 estimates of

reliability for the total test ranged from about 0.90 to 0.95. The examination, which was developed cooperatively by faculty at the two basic science schools, was administered to all medical students at the end of their first year. Students must pass this examination to be promoted to the second year of medical school.

Analysis. The independent variables were subscores from the MCAT, undergraduate grade-point average (UGPA), and total scores from the Level III teaching/learning examinations. The dependent variables were total scores on the Basic Science Comprehensive (BSC), National Board: Part I (NB: Pt I), and Level III examinations. Thus, total scores on Level III examinations served as either an independent or a dependent variable depending on the criterion being predicted.

Pearson product-moment correlations were calculated between the independent and dependent variables. Multiple linear regression (stepwise) was used to determine the extent to which

1. BSC total scores could be predicted from
    a. MCAT subscores,
    b. UGPA,
    c. Level III total scores,
    d. a combination of MCAT subscores and UGPA;
2. National Board: Part I total scores could be predicted from
    a. MCAT subscores,
    b. UGPA,
    c. Level III total scores,
    d. a combination of MCAT subscores and UGPA; and
3. Level III total scores could be predicted from
    a. MCAT subscores,
    b. UGPA,
    c. a combination of MCAT subscores and UGPA.

Further, the multiple correlation coefficients obtained in the regression analysis outlined above were compared to one another to determine if significant differences existed.

RESULTS

Basic descriptive statistics for both the independent and dependent variables appear in Table 1. Means, standard deviations, and sample sizes are given for the Classes of 1980-1983.

Insert Table 1 about here

The zero-order correlations of the four MCAT subscores with Level III, BSC, and NB: Pt I total scores are given in Table 2. It can be seen that these correlations fluctuated considerably from year to year. The correlations ranged from about -0.17 to 0.58. From Table 2, it can be observed that the MCAT Science subscore yielded the highest zero-order correlations with all three criterion variables. The MCAT General Information subscore produced the lowest zero-order correlations with the criterion variables. The zero-order correlation of UGPA with the three criterion variables ranged from 0.02 to 0.30, with correlations generally ranging from 0.22 to 0.30. It should be noted that UGPA did not correlate as highly as the MCAT Science subscore with the three criterion variables. However, correlations between UGPA and the criterion variables were higher than those between the MCAT General Information score and the criterion variables.

Insert Table 2 about here

The correlations of the subscores from the New MCAT with Level III, BSC, and NB: Pt I total scores ranged from -0.13 to 0.51; these data are presented in Table 3 for the Classes of 1982 and 1983. Again, as in the case of the Old MCAT, one particular subscore has the highest zero-order correlations with the criterion variables. In the case of the New MCAT, it is the Chemistry subscore. There also appears to be one subscore (Skills Analysis: Reading) which consistently has the lowest zero-order correlations with the criterion variables. For the Classes of 1982 and 1983, undergraduate grade-point average had zero-order correlations with the criterion variables which ranged from 0.19 to 0.32. Undergraduate grade-point average yielded lower zero-order correlations with the criteria than the MCAT Chemistry subscore and higher zero-order correlations than the MCAT Reading subscore.

Insert Table 3 about here

The zero-order correlations of the Level III total scores with BSC and NB: Pt I total scores are shown in Table 4. The Level III total scores had larger zero-order correlations with BSC and NB: Pt I total scores than either the MCAT subscores and UGPA, taken singularly or jointly. The correlations between Level III total scores and the BSC and NB: Pt I total scores ranged from 0.51 to 0.78. Table 4 also contains the zero-order correlations between performance on the BSC and NB: Pt I examinations; the correlations were 0.94 (Class of 1980), 0.42 (Class of 1981) and 0.89 (Class of 1982).

Insert Table 4 about here

The next step in the analysis was to use multiple linear regression (stepwise). The results of these regression analyses appear in Table 5. In the Classes of 1980 and 1981, the inclusion of more than one variable in the regression equation did not significantly increase the correlation coefficient. It should also be noted that no matter what the combination of variables (as explained in "Analysis"), only one variable was entered in the stepwise regression procedure. While it is possible to increase the multiple regression coefficient by forcing the inclusion of other variables, any increase in the multiple correlation coefficient would surely disappear when cross-validation techniques are applied (Kerlinger and Pedhazur, 1973).

Insert Table 5 about here

For the class of 1982, the BSC and NB: Pt I total scores were most parsimoniously predicted by only one variable (see Table 5). However, for the Class of 1982, Level III total scores were most parsimoniously predicted by only one variable (see Table 5). However, for the Class of 1982, Level III total scores were most parsimoniously predicted by three variables (analysis 3c). The multiple correlation was 0.54; the predictor variables were MCAT Chemistry subscore, UGPA, and MCAT Biology subscore (listed in order of inclusion in the equation). In analysis 3a, a multiple correlation of 0.47 was obtained; the predictor variables were MCAT Chemistry and Biology subscores.

For the Class of 1983, it was only possible to predict Level III total scores since students have not taken either the BSC or the NP: Pt I. The Level III total score was best predicted by a combination of four predictor variables; the multiple correlation was 0.49 (analysis 3c). The four predictor variables were the MCAT Chemistry subscore, MCAT Biology subscore, MCAT--Skills

Analysis: Reading subscore, and UGPA (listed in order of inclusion into the regression equation). In analysis 3a, three MCAT subscores were the best predictors ($R = 0.45$). These were the MCAT Chemistry, MCAT Biology, and MCAT Skills Analysis: Reading subscores.

In summary, relative to the Old MCAT, the highest zero-order correlations were obtained when performance on the criterion measures (Level III, BSC, and NB: Pt I examinations) was examined in relation to the MCAT Science subscores. These zero-order correlations ranged from 0.29 to 0.58. In relation to the New MCAT, the highest zero-order correlations occurred when Chemistry subscores were correlated with the criterion measures; these coefficients ranged from 0.46 to 0.51. Thus, the Chemistry subscore from the New MCAT appears to yield more stable predictive validities than the Science subscore from the Old MCAT. The predictive validity of undergraduate grade-point average was less than that of either Old MCAT Science subscore or New MCAT Chemistry subscore, but superior to that of the remaining MCAT subscores. The largest validity coefficients were obtained when scores from locally developed teaching/learning examinations were used to predict Basic Science and National Board: Part I total scores; these coefficients ranged from 0.50 to 0.80.

The use of multiple linear regression appeared to have little advantage over single variable regression for the Classes of 1980 and 1981. Additionally, there was no gain in predictive efficiency when multiple regression was used to predict either BSC or NB: Part I total scores for students in the Class of 1982. For students in the Classes of 1982 and 1983, however, validity coefficients associated with Level III total scores were increased through the use of multiple regression. In particular, the New MCAT Chemistry and Biology scores, along with undergraduate grade-point average, produced validity coefficients approaching 0.50.

CONCLUSION

Although the predictive validity of the New MCAT appears to be superior to that of the previous version, it is not possible to generalize beyond the data presented. Additional study is necessary to determine if validity coefficients will remain stable over several classes of students or if they will fluctuate considerably as did the validity coefficients from the previous MCAT. It should be noted that, based on data from two classes, substantial fluctuations in the Reading score are already apparent. For example, the predictive validities range from -0.13 (Class of 1983, Level III total scores) to 0.19 (Class of 1982, Level III total scores). Validity coefficients associated with the remaining MCAT scores and the three criterion measures do not exhibit such marked instability.

Predictive validity coefficients were maximized when data gathered during the first two months of the basic science educational program were used to predict performance on two certifying examinations, i.e., the Basic Science Comprehensive and National Board: Part I examinations. The increased predictive effectiveness of locally gathered data was noted across all four classes of medical students. Thus, it is recommended that medical educators who are interested in the prediction of success analyze their own programs carefully to determine which programmatic variables are most associated with success in the program. It appears that greater effectiveness in the prediction of performance in medical school will be achieved by utilizing programmatic data rather than utilizing either undergraduate grade-point average or scores from the Medical College Admission Test.

REFERENCES

Association of American Medical Colleges. New MCAT Student Manual, Washington, D.C., AAMC, 1976.

Association of American Medical Colleges. New Medical College Admission Test Interpretative Manual. Washington, D.C., AAMC, 1977.

Ambrosino, J., and Brading, P. An Analytical Computer-Based Methodology for Screening Medical School Applicants. Journal of Medical Education, 48 332-337, 1973.

Best, W. R., Dickema, A. J., Fisher, L. A., and Smith, N. E. Multivariate Prediction in Selecting Medical Students. Journal of Medical Education, 46: 42-50, 1971.

Bott, E. A. The Predictive Value of College Marks in Medical Subjects. Journal of Educational Research, 12: 214-227, 1925.

Crowder, D. G. Prediction of First-Year Grades in a Medical College. Educational and Psychological Measurement, 19: 637-639, 1959.

Deighton, C., Smith, D. U., and Gallagher, E. The Relationship Between Scores on the New Medical College Admission Test and Performance in the First Year of Medical School: A Preliminary Study. Paper presented at Research in Medical Education Conference, Washington, D.C., October, 1979.

Gough, H. G. Some Predictive Implications of Premedical Scientific Competence and Preferences. Journal of Medical Education, 53: 291-300, 1978.

Gough, H. G., and Hall, W. R. Prediction of Performance in Medical School from the California Psychological Inventory. Journal of Applied Psychology, 48(4): 218-226, 1964.

Gough, H. G., Hall, W. B., and Harris, R. E. Admission Procedures as Forecasters of Performance in Medical Training. Journal of Medical Education, 38: 983-998, 1963.

Kerlinger, F. N., and Pedhazur, E. I. Multiple Regression in Behavioral Research. New York: Holt, Rinehart, and Winston, Inc., 1973.

Richards, J. M. Review of the MCAT, in Buros, O.K. (Ed). The Seventh Mental Measurement Yearbook. Highland Park, N.J., Gryphon Press, 1972.

Richards, H., Jr, and Taylor, C. W. Predicting Academic Achievement in a College of Medicine from Grades, Test Scores, Interviews, and Ratings. Educational and Psychological Measurement, 21(4): 987-994, 1961.

Schwartzman, A. E., Hunter, R.C.A., and Lohrenz, J. G. Factors Related to Medical School Achievement. Journal of Medical Education, 37: 749-759, 1962.

Sorlie, W., Anderson, J., Gamble, T., and Bloomfield, D. A One-Year Program in Basic Medical Sciences. Journal of Medical Education, 48: 371-373, 1973.

Thomson, D. S., Essex, D. L., and Sorlie, W. E. A Two Phase Strategy for the Early Identification of Potential Academic Problems in Medical School, paper presented at Research in Medical Education Conference, New Orleans, October, 1978.

wpc/del-f/cs/2-29-80

TABLE I

Descriptive Statistics for Independent and Dependent Variables: Classes of 1980-1983

Class of	Mean	SD	n
1980			
UGPA	4.654	.248	98
MCAT-V	56.990	7.979	98
MCAT-Q	65.102	7.503	98
MCAT-G	54.327	7.660	98
MCAT-S	65.010	5.410	98
Level III	97.594	20.951	98
BSC	62.816	9.008	98
NB: Pt I	485.461	89.752	76
1981			
UGPA	4.678	.234	98
MCAT-V	60.020	7.867	98
MCAT-Q	66.378	4.819	98
MCAT-G	55.969	6.649	98
MCAT-S	67.939	6.214	98
Level III	107.070	17.488	98
BSC	65.755	69.325	64
1982			
UGPA	4.672	.226	95
MCAT-Bio	9.611	1.690	95
MCAT-Chem	9.621	1.702	95
MCAT-Physics	9.663	1.927	95
MCAT-Sci Prob	9.611	1.703	95
MCAT-SA/Reading	9.337	1.796	95
MCAT-SA/Quant	9.568	1.748	95
Level III	105.020	15.826	95
BSC	63.958	8.652	95
NB: Pt I	445.213	90.835	47
1983			
UGPA	4.601	.248	103
MCAT-Bio	9.505	1.558	103
MCAT-Chem	9.699	1.614	103
MCAT-Physics	9.728	1.664	103
MCAT-Sci Prob	9.874	1.625	103
MCAT-SA/Reading	9.466	1.545	103
MCAT-SA/Quant	9.767	1.722	103
Level III	97.139	17.822	102

TABLE 2

Zero-Order Correlations Between the Four MCAT Subscores, UGPA, Level III and NB: Pt I (Classes 1980 and 1981)

Class of	MCAT-V	MCAT-Q	MCAT-G	MCAT-S	UGPA
1980					
Level III n=97	-.08	.07	-.09	.25	.22
BSC n=97	-.08	.22	-.17	.41	.27
NB: Pt I n=75	.03	.09	-.03	.30	.23
1981					
Level III n=98	.23	.29	.02	.41	.22
BSC n=98	.24	.26	.14	.29	.02
NB: Pt I n=64	.36	.34	.26	.58	.30

TABLE 3

Zero-Order Correlations Between New MCAT Subscores, UGPA, and Level III, BSC, and NB: Pt I Total Scores (Classes of 1982 and 1983)

	Medical College Admission Test Subscores						
Class of	Bio	Chem	Phys	Sci Prob	SA:R	SA:Q	UGPA
1982							
Level III n=95	.39	.43	.26	.29	.19	.23	.32
BSC n=95	.34	.46	.20	.27	.03	.19	.21
NB: Pt I n=47	.38	.51	.15	.24	.16	.30	.19
1983							
Level III n=103	.33	.33	.21	.31	-.13	.10	.26

TABLE 4

BSC, Level III, and NB: Pt I Intercorrelations

Class of	BSC Total Scores	Level III Total Scores
1980		
Level III n=97	.72	
NB: Pt I n=75	.94	.69
1981		
Level III n=98	.51	
NB: Pt I n=64	.42	.68
1982		
Level III n=95	.72	
NB: Pt I n=47	.89	.78

TABLE 5

Prediction of Basic Science Comprehensive, National Board: Part I, and Level III Total Scores: Classes of 1980-1983

	Criterion Variables								
	Basic Science Comprehensive			National Board: Part I			Level III		
Class of	Analysis	R	Variables Entered	Analysis	R	Variables Entered	Analysis	R	Variables Entered
1980	1a	.41	MCAT-Sci	2a	.30	MCAT-Sci	3a	.25	MCAT-Sci
	1b	.27	UGPA	2b	.23	UGPA	3b	.22	UGPA
	1c	.72	Level III	2c	.69	Level III	3c	.25	MCAT-Sci
	1d	.41	MCAT-Sci	2d	.30	MCAT-Sci			
1981	1a	.29	MCAT-Sci	2a	.58	MCAT-Sci	3a	.41	MCAT-Sci
	1b	.02	UGPA	2b	.30	UGPA	3b	.22	UGPA
	1c	.51	Level III	2c	.68	Level III	3c	.41	MCAT-Sci
	1d	.29	MCAT-S	2d	.58	MCAT-Sci			
1982	1a	.46	MCAT-Chem	2a	.51	MCAT-Chem	3a	.47	MCAT-Chem, Bio
	1b	.21	UGPA	2b	.19	UGPA	3b	.32	UGPA
	1c	.72	Level III	2c	.78	Level III	3c	.54	MCAT-Chem, UGPA, MCAT-Bio
	1d	.46	MCAT-Chem	2d	.51	MCAT-Chem			
1983							3a	.45	MCAT-Chem, Bio, SA/R
							3b	.26	UGPA
							3c	.49	MCAT-Chem, Bio, SA/R, UGPA